AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of modifying an object with electrons comprising the steps of:

electrons from a planar electron emitting portion of a cold-cathode electron emitter according to a tunnel effect;

applying a voltage to said emitter to emit the electrons from said planar electron emitting portion; and

exposing the object to the electrons,

wherein said emitter comprises a pair of first and second electrodes, and a strong field drift layer ~~including nanocrystalline silicon~~ disposed between [[said]]the first and second electrodes,

wherein the strong field includes columnar polycrystalline silicon grains extending toward the first electrode, first silicon oxide thin films formed in surfaces of the silicon grains, fine grains of nanocrystalline silicon formed between the adjacent silicon grains, and second silicon oxide thin films formed in surfaces of the fine grains, and

wherein the electrons are emitted from said planar electron emitting portion by applying the voltage between [[said]]the first and second electrodes.

2. (Canceled)

3. (Original) The method as set forth in claim 1, wherein the object is exposed to the electrons under a pressure substantially equal to atmospheric pressure.

4. (Original) The method as set forth in claim 1, comprising the steps of accelerating the electrons emitted from said emitter to irradiate the accelerated electrons to the object.

5. (Original) The method as set forth in claim 1, wherein an energy of the electrons is in a range of 1 eV to 50 keV.

6. (Original) The method as set forth in claim 5, wherein the energy of the electrons is in a range of 1 eV to 100 eV.

7. (Previously Presented) The method as set forth in claim 1, wherein a space between said emitter and said object is filled with a dry gas.

8. (Original) The method as set forth in claim 7, wherein said dry gas includes at least one of oxygen and nitrogen.

9. (Original) The method as set forth in claim 1, wherein a gas having a smaller electron affinity than oxygen is filled in a space between said emitter and said object.

10. (Original) The method as set forth in claim 1, wherein said object is placed to directly contact said planar electron emitting portion of said emitter.

11. (Currently Amended) An apparatus for modifying an object with electrons comprising:

a cold-cathode electron emitter, which has the capability of emitting electrons from a planar electron emitting portion according to tunnel effect;

voltage applying means for applying a voltage to said emitter to emit the electrons from said planar electron emitting portion; and

a case for accommodating said emitter therein, said case having an opening, through which the electrons or a gas activated by the electrons are provided,

wherein said cold-cathode electron emitter comprises a pair of first and second electrodes, and a strong field drift layer ~~including nanocrystalline silicon~~ disposed between the first and second electrodes,

wherein the strong field includes columnar polycrystalline silicon grains extending toward the first electrode, first silicon oxide thin films formed in surfaces of the silicon grains, fine grains of nanocrystalline silicon formed between the adjacent silicon grains, and second silicon oxide thin films formed in surfaces of the fine grains, and

wherein said voltage applying means applies the voltage between the first and second electrodes to emit the electrons from said planar electron emitting portion.

12. (Canceled)

13. (Withdrawn) The apparatus as set forth in claim 11, further comprising a holder for supporting the object at outside of said case such that the electrons are irradiated to the object through said opening.

14. (Original) The apparatus as set forth in claim 11, wherein said case has an intake port for supplying a gas as the object therein, so that said gas is activated in said case by the electrons, and then provided outside through said opening.

15. (Currently Amended) An apparatus for modifying an object with electrons comprising:

a cold-cathode electron emitter, which has the capability of emitting electrons from a planar electron emitting portion according to tunnel effect;

voltage applying means for applying a voltage to said emitter to emit the electrons from said planar electron emitting portion; and

a case for accommodating said emitter therein, said case having an opening, through which the electrons or a gas activated by the electrons are provided,

wherein said cold-cathode electron emitter comprises a pair of first and second electrodes, and a strong field drift layer ~~including nanocrystalline silicon~~ disposed between the first and second electrodes,

wherein the strong field includes columnar polycrystalline silicon grains extending toward the first electrode, first silicon oxide thin films formed in surfaces of the silicon grains, fine grains of nanocrystalline silicon formed between the adjacent silicon grains, and second silicon oxide thin films formed in surfaces of the fine grains, [[and]]

wherein said voltage applying means applies the voltage between the first and second electrodes to emit the electrons from said planar electron emitting portion, and

wherein said cold-cathode electron emitter is provided with a pair of cold-cathode electron emitters disposed in said case such that the electrons are provided in opposite directions through a pair of openings formed in said case when the voltage is applied between the first electrodes and the second electrodes of said emitters by said voltage applying means.

16. (Original) The apparatus as set forth in claim 11, further comprising an accelerating electrode for accelerating the electrons emitted from said emitter, which is positioned in face-to-face relation with said planar electron emitting portion.

17. (Original) The apparatus as set forth in claim 16, wherein said accelerating electrode is an anode electrode, and a gas supplied into a clearance between said case and said anode electrode is activated by the electrons provided through said opening.

18. (Previously Presented) The apparatus as set forth in claim 11, wherein the first electrode is composed of an array of first electrode strips, which are arranged to be spaced from each other in a lateral direction, and the second electrode is composed of an array of second electrode strips, which are arranged to be spaced from each other in a direction intersecting with said lateral direction,

wherein the electrons are selectively emitted from said planar electron emitting portion corresponding to an intersecting region(s) between at least one of the first electrode strips and at least one of the second electrode strips when the voltage is applied therebetween by said voltage applying means.

19. (Previously Presented) The apparatus as set forth in claim 18 further comprising a first selector for selecting at least one of the first electrode strips, and a second selector for selecting at least one of the second electrode strips,

wherein said voltage applying means applies the voltage between at least one of the first electrode strips selected by the first selector and at least one of the second

electrode strips selected by the second selector to selectively emit the electrons from said planar electron emitting portion corresponding to the intersecting region(s) therebetween.

20. (Withdrawn) An apparatus for modifying an object with electron comprising:

a cold-cathode electron emitter, which has the capability of emitting electrons from a planar electron emitting portion according to tunnel effect;

voltage applying means for applying a voltage to said emitter to emit the electrons from said planar electron emitting portion; and

a holder for supporting the object such that the object is exposed to the electrons.

21. (Withdrawn) The apparatus as set forth in claim 20, wherein said cold-cathode electron emitter comprises a pair of electrodes, and a strong field drift layer including nanocrystalline silicon disposed between said electrodes, and wherein the voltage applying means applies the voltage between said electrodes to emit the electrons from said planar electron emitting portion.